Mapping LWM2M model to CoMI YANG

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(Work in Progress)

Purpose

- Standard organisations (BACnet, KNX, ZigBee, oBIX, OMA/IPSO) define hierarchical models that can be specified in XML and describe classes with attributes and operations that can be instantiated to objects.

    - OMA LWM2M and IPSO standardise numbered object types.

- CoMI at IETF (draft-vanderstok-core-comi-09) describes a network management interface based on CoAP and YANG.

- Goal: convert a LWM2M xml-based device specification to a YANG MODULE for CoMI consumption.

Conversion Rules
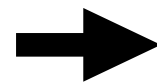
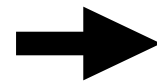| LWM2M	→	YANG
optional /mandatory attribute		false / true statement
R, W attributes		Config parameter (False=R, True=W)
E attribute		YANG rpc
range attribute		range statement
units		units statement

Resources		Leafs on a YANG list
		`+--ro ID3301* [instance_number]`
		`+--ro 5700 uint16`

Object Instance		"instance" key attribute

URI Conversion

	LWM2M →	YANG

LWM2M

URI:

http://example.com/type/instance/resource

coap+lwm2m://example.com/type/instance/resource

YANG

RESTCONF URI (example 3):

http://example.com/type/instance/resource

CoMI URI (example 3):

coap://example.com/type/resource**?key=0**

if only one instance then

coap://example.com/type/resource

- Keys as query parameter for instance number.

IPSO Humidity Object

Object definition

Name	Object ID	Instances	Mandatory	Object URN
Humidity	0	Multiple	Mandatory	urn:oma:lwm2m:ipso:3304

Resource definitions

ID	Name	Operations	Instances	Mandatory	Type
5700	Sensor Value	R	Single	Mandatory	Float
5601	Min Measured Value	R	Single	Optional	Float
5602	Max Measured Value	R	Single	Optional	Float
5603	Min Range Value	R	Single	Optional	Float
5604	Max Range Value	R	Single	Optional	Float
5701	Sensor Units	R	Single	Optional	String
5605	Reset Min and Max	E	Single	Optional	Opaque

Generated YANG modules

[ ]   list keys

rw   configuration data (read and write)

ro   state data (read only)

?   optional node

*   list and leaf list

( )   choice

:   case nodes

...   subtrees not shown

1. module: **ietf-yang-humidityID**
```
   +--ro ID3301* [instance_number]
      +--ro instance_number    uint16
      +--ro ID5700              decimal64
      +--ro ID5701?             string
      +--ro ID5601?             decimal64
      +--ro ID5602?             decimal64
      +--ro ID5603?             decimal64
      +--ro ID5604?             decimal64
      +---x ID5605
```

2. module: **ietf-yang-humidityNM**
```
   +--ro IPSO-humidity* [instance_number]
      +--ro instance_number         uint16
      +--ro Sensor_Value            decimal64
      +--ro Units?                  string
      +--ro Min_Measured_Value?     decimal64
      +--ro Max_Measured_Value?     decimal64
      +--ro Min_Range_Value?        decimal64
      +--ro Max_Range_Value?        decimal64
      +---x Reset_Min_and_Max_measured_values
```

Generated YANG modules

[ ]   list keys

rw   configuration data (read and write)

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?   optional node

*****   list and leaf list

( )   choice

:   case nodes

...   subtrees not shown

```
3. module: ietf-yang-humidityLF
      +--rw IPSO-humidity
         +--ro identifier     uint16
         +--ro resources* [instance_number]
            +--ro instance_number  uint16
            +--ro Sensor_Value
            |  +--ro identifier?    uint16
            |  +--ro content        decimal64
            +--ro Units
            |  +--ro identifier?    uint16
            |  +--ro content?       string
            +--ro Min_Measured_Value
            |  +--ro identifier?    uint16
            |  +--ro content?       decimal64
            +--ro Max_Measured_Value
            |  +--ro identifier?    uint16
            |  +--ro content?       decimal64
            +--ro Min_Range_Value
            |  +--ro identifier?    uint16
            |  +--ro content?       decimal64
            +--ro Max_Range_Value
            |  +--ro identifier?    uint16
            |  +--ro content?       decimal64
            +--ro Reset_Min_and_Max_measured_values
               +--ro identifier?    uint16
               +---x reset
```

Takeaways

- YANG is richer and more verbose than LWM2M.

- Multiple ways to express the same thing.

- IMO YANG still seems a bit overkill, CoMI might be able to use more purposely together with legacy devices.

- Both .XML (3482 characters) and .YANG (4570 characters) have a lot of "noise" in them. Curious about CCL conversion.

- Key leafs are just one possible way to represent instances.

- Access Control mapping might not be ideal.

- YANG has no Float, we use 64 bit precision (float is 32).

- Need to script automatic conversion.

- Where would a converter run? GWs, devices, server?

Links

- http://ipso-alliance.github.io/pub/

- http://technical.openmobilealliance.org/Technical/technical-information/release-program/current-releases/oma-lightweightm2m-v1-0

- http://jaimejim.github.io/drafts/draft-vanderstok-core-yang-lwm2m-00.txt

- jaimejim.github.io/drafts/3304.xml

- jaimejim.github.io/drafts/3304.yang

3304.yang

```
module ietf-humidityID{

  yang-version 1.1;   // needed for action

  namespace
      "urn:ietf:params:xml:ns:yang:ietf-humidityID";

  prefix humid;

  organization
    "IPSO";

  contact
     "WG Web:    http://tools.ietf.org/wg/core/
      WG List:   mailto:core@ietf.org

      WG Chair: Carsten Bormann
                mailto:cabo@tzi.org

      WG Chair: Jaime Jimenez
                mailto:jaime.jimenez@ericsson.com

      Editor:    Peter van der Stok
                mailto:consultancy@vanderstok.org

      Editor:    Jaime Jimenez
                mailto:jaime.jimenez@ericsson.com";

  description
    "This module contains information about the operation of the IPSO LWM2M humidity sensor with ID 3301.

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     authors of the code.  All rights reserved.

     Redistribution and use in source and binary forms, with or

     without modification, is permitted pursuant to, and subject
     to the license terms contained in, the Simplified BSD License
     set forth in Section 4.c of the IETF Trust's Legal Provisions
     Relating to IETF Documents
     (http://trustee.ietf.org/license-info).

     This version of this YANG module is part of RFC XXXX; see
     the RFC itself for full legal notices.";
```

```
revision "2016-07-25" {
    description "Initial revision.";
    reference
      "I-D:draft-vanderstok-core-yang-LWM2M: YANG language applied to the LWM2M IPSO humidity sensor specification";
  }


    list ID3301 {
      key instance_number;
      config  false;       // should be same for key leaf
      description
        "IPSO humidity: The humidity sensor is composed of a set of instances";
          leaf instance_number {
              type uint16{
                  range "0..1";    // only one instance zero (0)
              }
              config false;      // R access
              mandatory "true";
              description
                "the number of the humidity sensor instance";
          }
          leaf ID5700 {
              type decimal64{      // YANG has no float
                      fraction-digits 2;
                      range "10.0 .. 66.6";}
              config false;      // R access
              mandatory "true";
              description
                "Sensor Value: Last or Current Measured Value from the Sensor";
          }
          leaf ID5701 {
              type string;
              units "Defined by 'Units' resource";
              config false;      // R access
              description
                "Units: Measurement unit definition e.g. 'Cel' for temperature in Celsius";
          }
```

```
          leaf ID5602 {
              type decimal64{      // YANG has no float
                      fraction-digits 2;
                      range "10.0 .. 66.6";}
              units "Defined by 'Units' resource";
              config false;      // R access
              description
               "Max Measured Value: The maximum value measured by the sensor since power ON or reset";
          }
          leaf ID5603 {
              type decimal64{      // YANG has no float
                      fraction-digits 2;
                      range "10.0 .. 66.6";}
              units "Defined by 'Units' resource";
              config false;      // R access
              description
               "Min Range Value: The minimum value that can be measured by the sensor";
          }
          leaf ID5604 {
              type decimal64{      // YANG has no float
                      fraction-digits 2;
                      range "10.0 .. 66.6";}
              units "Defined by 'Units' resource";
              config false;      // R access
              description
               "Max Range Value: The maximum value that can be measured by the sensor";
          }
          action ID5605 {
              //E access: this is an RPC without input and output parameters
              description
               "Reset Min and Max measured values: Reset the Min and Max measured values to current value";
          }
      } // list ID3301
} // module ietf-yang-humidity
```